

REMARKS

Claims 1-11 are pending. All claims are rejected.

Claim 1 has been amended to recite a feature of the claimed method “wherein said positions at which the second grooves are formed are decided by performing a trial division in advance.” Support is found, for example, in the first full paragraph on page 5 of the specification as filed.

No new matter has been introduced. Entry and consideration are respectfully requested.

Response to Rejection under 35 U.S.C. § 103

A. Claims 1, 3-7, and 11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over JP 10125958 to Shuji et al. (“Shuji”) in view of U.S. Patent 4,604,161 to Araghi (“Araghi”).

Shuji was cited as teaching a method for the production of gallium nitride compound semiconductor chips from a wafer having gallium nitride compound semiconductor layers laminated on a principal surface of a substrate formed of hexagonal crystal, comprising: a step of linearly forming first grooves in a desired chip shape by etching on a side of the gallium nitride compound semiconductor layers of said wafer ([0007], lines 1-6; Drawing 3, elements 11, 2, 3); a step of forming second grooves having a line width (W2) equal to or smaller than a line width (W1) of the first grooves on a side of the substrate of said wafer ([0007], lines 9-10; Drawing 3, elements W1, 11, W2, 22); and a step of dividing said wafer along said first and second grooves into pieces each of a chip shape ([0007], lines 11-12; [0010], lines 12-14; [0021], lines 9-10). The Examiner asserted that the wafers are separated along the “Chuo Line”.

The Examiner recognized that Shuji does not teach a step of forming second grooves having a line width (W2) equal to or smaller than a line width (W1) of the first grooves on a side of the substrate of said wafer at positions not conforming to the central lines of the first grooves.

Araghi is cited as teaching a step of forming second grooves of said wafer at positions not conforming to the central lines of the first grooves (column 3, lines 50-56; Fig. 3, elements 35, 37, 40, 44, 45).

The reason for combining the teaching of Araghi with the teaching of Shuji as asserted by the Examiner is to provide chips having precisely controlled ends and line edges for butting against the ends of like arrays.

Regarding claims 3-5, the Examiner recognized that Shuji in view of Araghi does not teach the claimed features but asserted that the features would have been obvious to a skilled artisan because “[w]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation” (citing *In re Aller*).

Regarding claim 6, Shuji is cited as teaching wherein said first grooves are confronted by an electrode-forming surface for forming an electrode for gallium nitride compound semiconductor chips (citing [0016] and Fig. 4).

On pages 2-4 of the Office Action, the Examiner further responded to Applicants’ remarks of May 18, 2009, which Applicants in turn address below.

(1) The Examiner responded to Applicants’ first position (on pages 6-7 of the Amendment of May 18, 2009), by asserting that Shuji cannot teach away from a feature it does not disclose (*i.e.*, slanted center lines). The Examiner took the position that because Shuji fails to

teach that the slanted center lines cannot be used for making slanted fracture lines, it does not teach away as Applicants argue.

However, Shuji does teach away from the modification with Araghi suggested by the Examiner. For a reference to teach away from a particular modification, it is not necessary that such a modification be taught as inoperable or impossible. Instead, teaching away is met where a reference criticizes, discredits, or discourages the aspect for which it is cited. See MPEP 2123.II, citing *In re Fulton* 391 F.3d 1195, 73 USPQ2d 1141 (Fed. Cir. 2004). Shuji clearly discredits slanted fracture lines (e.g., line c) and even prescribes width W1 to accommodate for such a slanting fracture line (e.g., line b) as shown in Fig. 1. Further, Shuji expressly teaches a “process which separates a wafer in the shape of a chip along the first rate slot and the second rate slot” ([0007])—that is, along the vertical center line. In this regard, the Examiner recognized that the fracture line of Shuji is intended to be vertical. It is precisely for this reason (that Shuji teaches that a slanted fracture line is not intended) that Shuji teaches away from a combination with the slanted center line of Araghi as suggested by the Examiner.

(2) The Examiner responded to Applicants’ second position (on page 7 of the Amendment), by asserting that the benefit taught in Araghi provides “a reason to combine Shuji with Araghi to achieve the [same] benefit.” The Examiner also responded to Applicants’ fourth position (on pages 8-9 of the Amendment), by asserting that a slanted cutting line is well known in the art and is the feature for which Araghi is relied upon. The Examiner also asserted that the specific fracture plane of Shuji is dependent on the sapphire material disclosed.

Applicants respectfully dispute the Examiner’s assertions, based on the following teaching of Shuji described in the latter half of paragraph [0010]:

"As shown by a broken line 'a' in Fig. 1, the wafer is most preferably divided into pieces each of a chip shape at positions where the center lines of the first grooves conform to the center lines of the second grooves. However, if the wafer is too thick, the wafer is likely to be divided obliquely as shown by a broken line "c" in Fig. 1, and even the p-n junction interface is cut off, resulting in chip pieces having undesired shapes." (Applicants' translation)

Accordingly, Shuji teaches that, in cutting the sapphire substrate, the wafer is divided along the line "a", "b", or "c" illustrated in Fig. 1, and thereby it is impossible to control the angle of oblique division. Shuji also teaches that the wafer, in which a nitride semiconductor is laminated on a sapphire substrate, does not possess cleavability (paragraph [0005]).

On the other hand, the invention disclosed in Araghi is an invention that utilizes the cleavability of a (100) silicon wafer. In the invention of Araghi, the step of "(a) etching a small V-shaped groove 35 in one side of a (100) silicon wafer defining the chip end, the walls 36 of the V-shaped groove paralleling the (111) crystalline plane 37 of the wafer 20" is indispensable (claim 1, lines 39-45 of column 3 and figure 3).

Cutting is made to occur from the bottom of the aforementioned V-shaped groove 35 along the walls 36, *i.e.*, along the (111) crystalline plane 37 (col. 3, line 64 to col. 4, line 3). An inside groove 40 is formed at a position where an extension of the (111) crystalline plane 37 reaches such that the cutting that utilizes the cleavability of a silicon wafer reliably occurs (col. 3, lines 50-56, col. 4, lines 44-47 and Figs. 4-6).

Accordingly, there is no motivation to combine Shuji, which uses a wafer having no cleavability, with Araghi, which uses a wafer which cleaves accurately at an angle of 54.7 degrees.

Furthermore, Shuji describes in paragraph [0010], *“Accordingly, by polishing the sapphire substrate down to a thickness within the above-mentioned range, it is possible to more easily divide the wafer at positions conforming to the grooves, i.e., into desired shapes.”* (Applicants’ translation). In other words, an object of Shuji is to divide the wafer into each piece of a chip shape at positions where the center lines of the first grooves conform to the center lines of the second grooves and thereby obtain each of the chips having a shape with a perpendicular section. This is different from the object of Araghi (col. 1, line 66 to col. 2, line 4), such that a skilled artisan would not have modified the teaching of the cited references as suggested by the Examiner.

(3) The Examiner responded to Applicants’ fifth position (on page 9 of the Amendment), by asserting that because Araghi discloses the general conditions of the cut face angle, it would have been obvious to test (optimize) the cut face angle to meet the features of claim 4.

As indicated in the remarks above, Shuji teaches in Fig. 1 that it is impossible to control the angle at which the sapphire substrate is divided obliquely. For this reason, the angle in the range of 60 to 85° would not have been obvious to one of ordinary skill in the art as asserted by the Examiner.

Further, the present specification describes, in lines 7 to 9 on page 5, that the side of the central lines of the first grooves 11 on which the second grooves 22 are to be formed may be decided by performing a trial division in advance. Claim 1 has been amended to further recite “wherein said positions at which the second grooves are formed are decided by performing a trial division in advance.”

As illustrated in Figs. 1 and 2 of the present application, the wafer used in the present invention is divided along a broken line “b” or “c”. Depending on the wafers, some wafers tend

to break along the broken line “b” and others along the broken line “c”. If the positions at which the second grooves are formed are determined after performing a trial division to see how the wafer tends to be divided, it is possible to divide the wafer into pieces of chip shape at a higher yield. The trial division in advance is required for dividing the sapphire substrate whose direction and angle to be divided are unknown. However, since the silicon substrate is cleaved accurately, it does not require such a trial division, which therefore is not disclosed or suggested in Araghi.

Reconsideration and withdrawal of the rejection are respectfully requested.

B. Claim 2 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Shuji in view of Araghi as applied to claim 1 above, and further in view of U.S. Patent Application Publication 2002/0014681 Al to Tsuda et al. (“Tsuda”) and U.S. Patent Application Publication 2002/0105986 Al to Yamasaki et al. (“Yamasaki”).

Shuji and Araghi were relied on as indicated above, but the Examiner recognized that the cited references fail to teach the features of claim 2. Tsuda was cited as teaching a method of producing a nitride semiconductor structure for employing in light-emitting devices wherein the substrate is formed of sapphire, with a C surface of the sapphire as the principal surface ([0057]). Yamasaki was cited as teaching a gallium nitride-based semiconductor wherein first grooves 32 and second grooves 34 are formed respectively along a first direction parallel to an orientation flat and along a second direction orthogonal to said first direction, and the wafer is divided along the first and second grooves ([0086]-[0092]; Figs. 3-5).

The reason for modification of Shuji and Araghi with the teaching of Tsuda and Yamasaki was to allow the growth of crystal structures on the substrate and to divide a wafer in accordance with forming a semiconductor laser device.

Claim 2 is patentable at least for the reasons stated in regard to claims 1, 3-7, and 11 above. Namely, Shuji teaches away from the modification with Araghi; a skilled artisan would not have modified the teachings of the cited references as suggested by the Examiner; and the cited references fail to teach or suggest “wherein said positions at which the second grooves are formed are decided by performing a trial division in advance” as required by amended claim 1. Reconsideration and withdrawal of the rejection are respectfully requested.

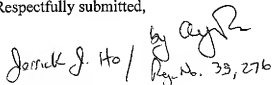
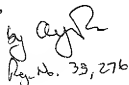
C. Claims 1 and 8-10 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Shuji in view of Araghi as applied to claim 1 above, and further in view of U.S. Patent Application Publication 2001/0038655 A1 to Tanaka et al.

Claims 1 and 8-10 are patentable at least for the reasons stated in regard to claims 1, 3-7, and 11 above. Namely, Shuji teaches away from the modification with Araghi as suggested; a skilled artisan would not have modified the teaching of the cited references as suggested; and the cited references fail to teach or suggest “wherein said positions at which the second grooves are formed are decided by performing a trial division in advance.” Reconsideration and withdrawal of the rejection are respectfully requested.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

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Respectfully submitted,

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